

A NEW SPECIES OF *PSEUDOPHRYNE*
(ANURA: LEPTODACTYLIDAE)
FROM NORTH-WESTERN AUSTRALIA

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Main and Calaby (1957) identified five specimens of frogs (W.A. Museum Nos. 11530-11534) collected at Cape Range, June, 1955, by A. M. Douglas as *Uperoleia marmorata* Gray. This identification was provisional and given with some misgivings because it had been made entirely on external characters as at that time it was not possible to make dissections or examine skeletons and so confirm the generic status.

Since then the type of *Uperoleia marmorata* Gray has been examined in the British Museum and it is clear that the five specimens collected by Douglas are not this species.

During 1961 in the western Hamersley Range and on another occasion in the Barlee Range, Upper Ashburton, the present author collected specimens which agree with the Cape Range specimens collected by Douglas in 1955. In the same year J. H. Calaby and Arnold Kluge were able to collect further specimens from the precise locality collected by Douglas six years earlier. All this material is con-specific and sufficiently numerous for the preparation of dissections and skeletal material. These reveal a large fronto-parietal foramen and no inner ear, no maxillary teeth and suggest that the specimens would be appropriately placed in the genus *Pseudophryne* Fitzinger.

The specimens do not agree with either of the two named species of *Pseudophryne* from Western Australia, nor can they be attributed to any species in Parker's 1940 revision, and are therefore described as

Pseudophryne douglasi sp. nov.

Uperoleia marmorata (non Gray). Main, A. R., and J. H. Calaby, 1957, *West Aust. Naturalist*, 5: 218-9.

Description of Holotype, W.A. Mus. No. 21255 Kookhabinna Gorge (Lat. 23° 10' S., Long. 115° 58' E.), 18.VIII 1961:

No vomerine teeth, no maxillary teeth, tympanum and inner ear absent. Snout conical, rounded anterior to nostrils, 1.5 times length of eye.

Loreal region slightly concave. Nostrils oblique lateral, nearer tip of snout than eye, distance between nostrils equal to distance of nostril to eye.

Head wider than long. Body long, slender, length snout to vent 25.5 mm.; limbs short. Ratio tibia to body 0.35. A pale orange patch on upper arm. Fingers moderate, stout, not fringed, the first shorter than second which is equal to or shorter than fourth, well developed subarticular tubercles.

Toes moderately stout, without any trace of webbing, not fringed, first shorter than second which is shorter than fifth, third

reaches ultimate joint of fourth, subarticular tubercles well developed. Two metatarsal tubercles, inner large and transverse, outer small conical.

Skin dorsally regularly beset with small conical warts, no folds over scapular region. Lower surfaces granular, belly pronouncedly so, continued laterally on belly and posteriorly on thighs. Parotid glands not conspicuously enlarged, no glands on thighs. Dark chocolate brown above with an orange triangle between eyes and over dorsal part of snout. A similarly coloured posteriorly pointing triangle or arrowhead over coccyx. A few small irregularly shaped orange marks on dorsum. Warts tipped in paler brown. Upper part of arm and thigh with orange spot, groin dark brown or black. Lower surfaces white, heavily marbled in dark brown, chin and throat dark brown with numerous small white spots.



Fig. 1.—Dorsal view of specimen of *Pseudophryne douglasi* sp. nov. from Kookhabinna Gorge, Barlee Range.

In bright light the pupil is a sector of a circle, but tends to be diamond-shaped when fully contracted. The lungs are elongated (length greater than 4 times width) and gonads yellow.

Specimens examined: ♂♂ 6, ♀♀ 4, juv. 3. Mount Herbert (Lat. 21° 15' S., Long. 115° 20' E.), Kookhabinna Gorge, Weeana, Butler's Gorge (on tributary of Henry River 20-25 miles S.W. of type locality), Shothole Canyon (N.W. Cape). All specimens agree with types. Ratio tibia/body ranges 0.34 to 0.40. Females are larger than males and the dorsal colouring is less distinct. Juveniles, like females, have less developed colouration. In formalin, orange colour fades, leaving dorsum uniformly dark.

Diagnosis: *Pseudophryne douglasi* can be distinguished from *Glauertia* by the unwebbed toes and more slender body. From *Uperoleia* by the presence of a fronto-parietal foramen, absence of inner ear and absence of white or orange patch in groin. Differs from *Pseudophryne guentheri* in the absence of two large transverse metatarsal tubercles; having two phalanges in the inner toe; lacking mottled colouring on dorsum, and lacking supra-scapular folds. *Pseudophryne douglasi* differs from *P. occidentalis* and *P.*

bibroni which are stouter frogs with flattened confluent warts on the dorsum. *P. bibroni* is further distinguished by the glandular area behind the thigh.

BIOLOGY

Life History

The specimens collected at Mt. Herbert were taken in May 1961 from shallow water adjacent to a small rock-strewn stream flowing out of a permanent spring near the roadside at the bottom of the descent from Mount Herbert. Along with the female were found in the water a total of 89 freshly-laid eggs which were 4.5 to 5.0 mm. in diameter of outer capsule and a mean of 2.2 mm. (range 2.0-2.3 mm.) in diameter of egg. Each egg was deposited singly in the water in the shelter of a cavity beneath a stone. The capsules were covered with silt and mud but did not adhere together nor were they attached to substrate or vegetation. A small number of eggs from this site were preserved; the remainder were returned to the Zoology Department yards where they were reared in order to confirm that the eggs belonged to the frogs collected at the same time. This series also provided data on the stages in the development of the larvae. By extraordinary good fortune it was possible in different localities during 1961 to make other collections of the larvae of this interesting species. These collections show the range of habitats occupied by the frog and larvae and also the larval tolerances to environmental extremes. Possibly the two environmental extremes are provided by the site at Weeanna (an unvegetated pool in rock) and in Kookhabinna Gorge (a large tree-lined permanent pool in a creek). In addition the field-caught animals provided data on the rate of development in nature and provided a check for those reared at Nedlands.

The larvae from all localities fixed at the time of collection have been staged according to the table of Gosner (1960) and the results are presented in Table 1. In some cases larvae have been returned to Nedlands for rearing. At Nedlands larvae from Kookhabinna Gorge metamorphosed at the same time as those from Mount Herbert. Individuals of this batch of larvae continued to metamorphose until December. The delay may be associated with the colder conditions at Nedlands. The unsheltered Weeanna Pool exposed to the north had the most advanced larvae and even young frogs were collected in August. The collecting party was only in the vicinity of these areas in the Barlee Range for a few days but during this time the skies were cloudless and temperatures ranged from a minimum of 29° F. at night to the vicinity of 90° F. during the day. Under these conditions the exposed pool at Weeanna would probably become so hot as to be lethal for larvae if it were not for evaporation and fed and cooled by water seeping from the joint fractures of the rock in which the pool occurred. It is doubtful whether the temperature of this pool ever exceeded 25° C. (77° F.).

At all sites the larvae tended to shelter in dark situations beneath stones (Weeanna) or dense algal mats (Kookhabinna and Butler's Gorge). In these last two sites the deeper more sheltered

TABLE 1.—*PSEUDOPHRYNE DOUGLASI*. LIFE HISTORY DATA FROM ALL LOCALITIES. NUMBERS REFER TO STAGES OF GOSNER (1960).

Date	Localities				
	Mount Herbert	Kookhabinna Gorge	Weeanna	Butler's Gorge	Shot Hole Canyon
1961					
May 12	Eggs*				
16-18	Hatching†				
June 14	25				
August 1	31				32-43
17		26-31*			
18			36-38 and Juveniles		
19				26-31	
September 24					
29	31-36				
October 10	Juveniles	Juveniles*			

*Transferred to pond in Zoology Department yards.

†While being transferred.

water would not experience the extremes of temperature such as at Weeanna. Those measurements taken from sites where larvae were collected, show early morning temperatures of 14° C. (ca. 57° F.) rising to about 20° C. (67° F.) later in the day.

Larvae

At hatching the body is about 3.5 mm. long and including tail the larvae is about 8.0 mm. long. At this stage the gut is formed and filled with yolk which distends the belly so that it appears pale. The remainder of the body is covered with small evenly-spaced melanophores which extend onto the dorsal and ventral crests of the tail fin.

At stage 25 the operculum opens on the left side about 2/3 of the way along the body, is transparent, attached on its inner side to the tip and opening obliquely upwards so that it is visible from

above. The mouth has five rows of teeth in a $\frac{1 \quad 1}{1 \quad 2 \quad 1}$ arrangement.

The lower outer row is as long as the preceding row. There are papillae only in the corner of the mouth. The anus opens to the right on a short tube. The colour is a uniform dark brown derived from the uniformly dispersed melanophores which show no aggregation and no pattern. There are many bright iridescent guanophores scattered over the body and tail. The tail is about 1.5 times the length

of the body, broadly rounded terminally. At about $1/3$ the length of the tail it is slightly deeper than the depth of the body.

At stage 28 the larvae have a body about 8.0 mm. long and tail about 11.5. Though there is considerable variability in tail length which now tends to be almost twice the body length and by stage 33 this tendency is pronounced. The anterior of the body is pale, posterior dark. The small melanophores are uniformly distributed. The dorsal crest of the tail is more pigmented than the ventral and the melanophores are aggregated into sinuous vertical lines. Neither the tooth rows or papillae alter. The opercular opening appears to be slightly anterior of the hatching position.

At stages 32-36 the body is broadly oval in outline, eyes dorso-lateral as far apart as distance from the snout. Nostrils equidistant from the eye and tip of snout and opening directly upwards. Colouration, position of spiraeulum, depth and relative length of tail, mouth parts and anus are as discussed earlier.

Larvae just prior to metamorphosis are dark with a blue sheen and bright blue and white melanophores. There is no orange dorsal stripe as in the larvae of *P. guentheri*. From about stage 38 the length of the tail is reduced relative to body length and may be less than 1.5 times body length. At metamorphosis young frogs are 12.0 to 14.0 mm. long and coloured as adults.

Behaviour

The young frogs and adults hop with both feet together and do not walk. While in water they swim with both feet together. Both characteristics are like *Crinia* and unlike *Pseudophryne guentheri* or *P. occidentalis*. The frogs from Mount Herbert and Kookhabinna occupied tunnels beneath large stones at the water's edge so that the tunnels were partly water-filled. When the overlying stones were disturbed the frogs immediately entered the water and swam to shaded dark situations beneath stones on the bottom.

In the same way when the overlying shelter (either stone or algal mat) was removed the larvae took refuge in dark areas beneath stones.

Adults of *Pseudophryne guentheri* and *occidentalis* are more buoyant and usually float on the surface. They do not readily enter water to escape when disturbed. The different behaviour of *Pseudophryne douglasi* is presumably associated with the reduced buoyancy resulting from the long slender lungs of this species.

Habitat

Apparently the minimum requirement is that there should be some form of cover associated with shallow water beneath which adult frogs can shelter. This minimum is only just met at Weeana and at Mount Herbert, while at Kookhabinna, stones, fallen cadjiput logs, and other debris among the *Cyperus vaginatus* and *Juncus*-grown fringes of the many large pools offers optimum habitat conditions.

The species is found with *Glauertia russelli* at Mount Herbert and associated under the same stone with *Hyla rubella* at Kookhabinna.

DISCUSSION

Literature

There are two references in the literature to specimens of the genus *Crinia* from "between Carnarvon and North West Cape." Parker (1940) attributed one of these to *Crinia georgiana* Tsehudi (Aust. Mus. No. 9979) and the other to *Crinia signifera* Girard (Aust. Mus. No. 9980). From a knowledge of the breeding biology of the genus *Crinia* and especially *Crinia georgiana* it is unlikely that these two specimens are correctly labelled. In this event there are two possibilities; either the specimens have the wrong locality data or if these are correct then the specimens may be wrongly classified. It is possible but unlikely that these two specimens belong to the present species. Unfortunately specimen R9980 cannot now be located (vide letter Dr. W. J. Evans, Director of the Australian Museum to Dr. W. D. L. Ride, Director of the Western Australian Museum, 4.v.59) though apparently it was sighted by Moore (1961, p. 233). However, specimen R9979 has been sighted; it has a white belly and throat, characters which immediately remove it from consideration as belonging with the present species.

General

This species is unusual because it is known only from within the tropics in a region of summer rainfall maximum. However, all collections suggest that the species breeds during winter (Table 1). The time of egg laying is comparable with that of *Pseudophryne guentheri* in the region of reliable winter rainfall.

It is possible that the winter breeding in 1961 was due to the absence of summer rain. However, two things suggest that this was not so. Firstly Douglas collected the first adults with larvae and eggs in June 1955. Secondly there were good summer rains in 1961 which were prolonged and followed by good winter-type rains in May. Following the excellent summer rains the May rains were sufficient to bring the rivers down so that roads were closed. It was after these rains that the Mount Herbert frogs bred.

The restricted nature of the situations in which *Pseudophryne douglasi* is found indicate that the relict distribution indicated by the range as at present known is real. However, it is dependent on early winter rainfall for breeding and therefore presumably a relict of a former time when winter rain was regular and widespread. This implies two things: (a) the frog is a relict of a Pleistocene pluvial because widespread winter-type rains in the high latitude tropics could only occur in glacial times; (b) since the former widespread occurrence there cannot have been a period when winter-type rainfall was less frequent or abundant than it is at present, because under more intense winter drought the species would readily become extinct in such minor situations as the spring at Shot Hole Canyon or Mount Herbert or the rock seep at Weeanna.

ACKNOWLEDGMENTS

The work reported in the present paper was done while the author was in receipt of a Research Grant from the University of

Western Australia. It is a pleasure to acknowledge the assistance of Messrs. Arnold Kluge and J. H. Calaby who brought back live larvae from Shot Hole Canyon. The specimens from the Barlee Range were obtained while the author was a member of a field survey team of the Western Australian Fauna Advisory Committee.

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FROM FIELD AND STUDY

Silver Gulls Nesting at the Crawley Baths, Swan River Estuary.
—On November 6, 1963, a chance conversation with a fisherman who traps cobblers in the Swan River revealed the fact that Silver Gulls (*Larus novae-hollandiae*) had been nesting on the back fence of the Crawley Baths for some considerable time. My informant was of the opinion that a pair of birds had nested three times this season but there were no young ones about to show that young birds were actually reared. As will be noted when the location of the nests is described, it is quite possible that the young chicks had fallen into the water and drowned when they started to walk out of the nest.

Soon after 8 a.m. on November 7 I inspected the site and found two nests with adult birds sitting tightly on them. One nest contained one young chick, probably two days old, while the other was only inspected with binoculars. With Miss C. A. Nicholls I made a further examination of the site later in the day and a series of photographs were taken. As the habitat was to be completely destroyed within the next few days, in connection with the dismantling of the Baths, Miss Nicholls rescued the chick to rear it at home. A third nest, empty, was also found. All three nests had been made with a small quantity of grass and were located on the tops of piles where the bearers made a small depression. They were within a hundred yards of a major road carrying dense traffic.

From the demolition crew at the Baths it was learnt that "a dozen or more" old nests were located on the back and side fences of the Baths. Neither of these fences had a platform for patrons and the nests could only be reached by doing a "Blondin act" along the top of the fence, or approaching in a boat.

The Crawley Baths were used up to the end of the 1962-63 summer season and afterwards only by odd keen swimmers until the lease expired in June 1963. Demolition began in late October, 1963.

—A. G. MATHEWS, South Perth